GROUP 37

POWER STEERING

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GENERAL INFORMATION

M2370000100851

Electric power steering system has been adopted for all models in order to ensure an optimised steering feeling.

FEATURES

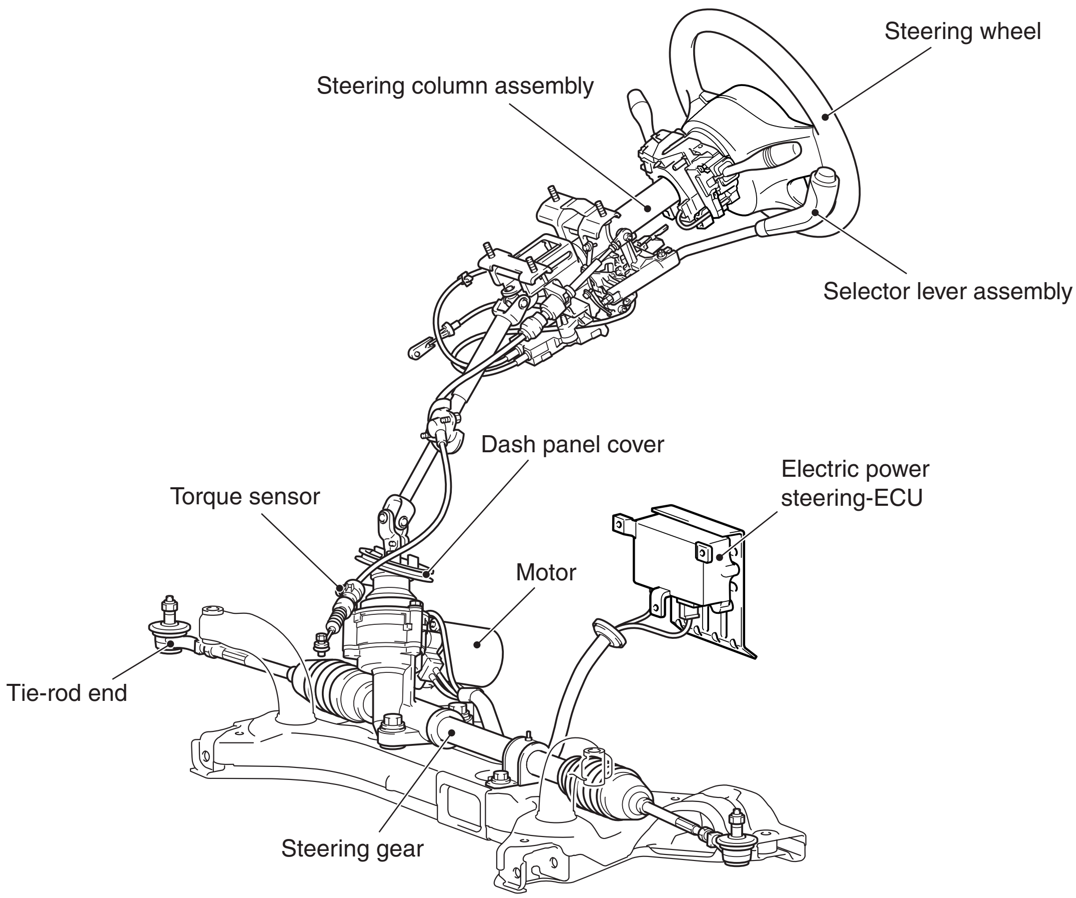
- Improved fuel consumption by reduction of engine load, and weight saving by decrease of the number of parts have been achieved with the introduction of the electric power steering system.
- 3-spoke type steering wheel integrated with an SRS airbag has been adopted.
- Impact-absorbing mechanism and tilt steering mechanism have been adopted.

SPECIFICATIONS

Item		Specifications		
		Vehicles with 14-inch wheels	**Vehicles with 15-inch wheels**	**Vehicles with 16-inch wheels**
Steering wheel	Type	3-spoke type		
	Outside diameter mm	370		
	Maximum number of turns	3.4	3.2	2.6
Steering column	Column mechanism	Shock absorbing mechanism and tilt steering mechanism		
Power steering type		Electric powered type		
Steering gear	Type	Rack and pinion		
	Stroke ratio (Rack stroke/Steering wheel maximum turning radius)	44.15		50.46
	Rack stroke mm	150	143	130
Steering angle	Inner wheel	41 ° 40’	39 ° 00’	34 ° 10’
	Outer wheel	35 ° 30’	33 ° 40’	30 ° 00’

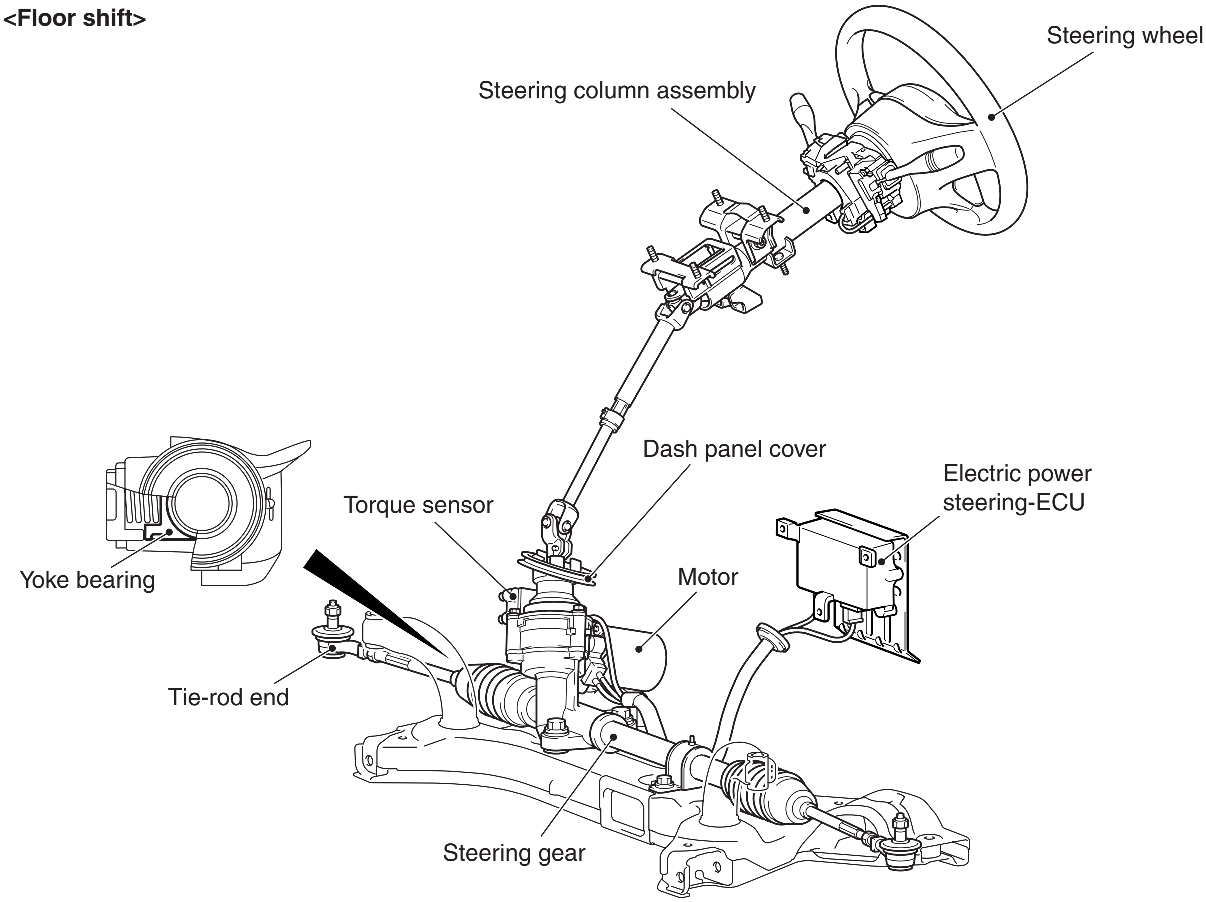
CONSTRUCTION DIAGRAM

<Smart shift>



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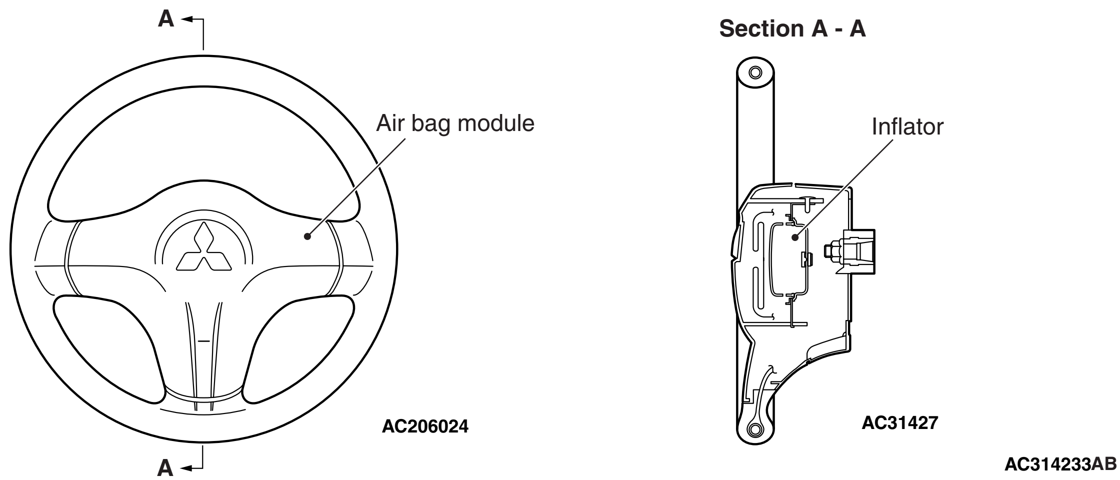
<Floor shift>


Steering wheel
Steering column assembly
Dash panel cover
Electric power steering-ECU
Torque sensor
Motor
Yoke bearing
Tie-rod end
Steering gear
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CONSTRUCTION DESCRIPTION

STEERING WHEEL

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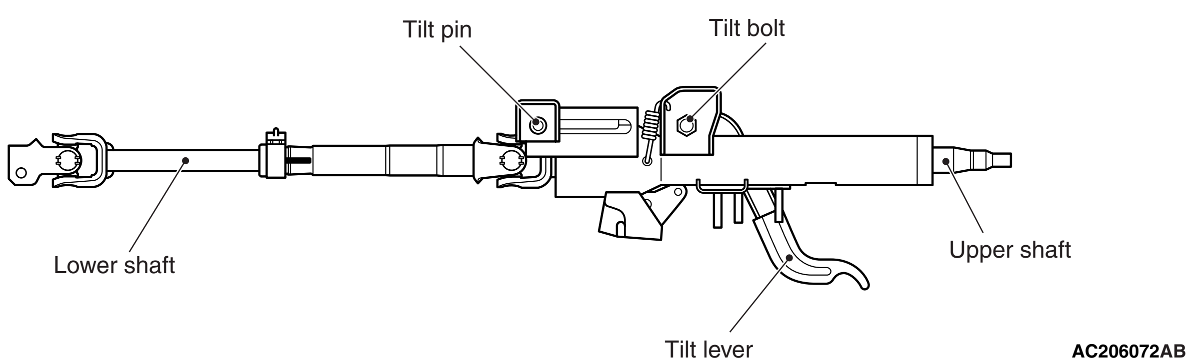


The steering wheel is designed to improve operation ability, safety and maintainability and has the following features:

- New 3-spoke type steering wheel which features urethane and real leather types has been adopted. The leather steering wheel is offered as a standard for the models with VRX, and offered as a standard for the models with LS.
- It has a built-in an SRS air bag to protect the driver in case of a frontal collision.
- The air bag module is equipped with an inflator that does not contain sodium azide.

STEERING SHAFT AND COLUMN

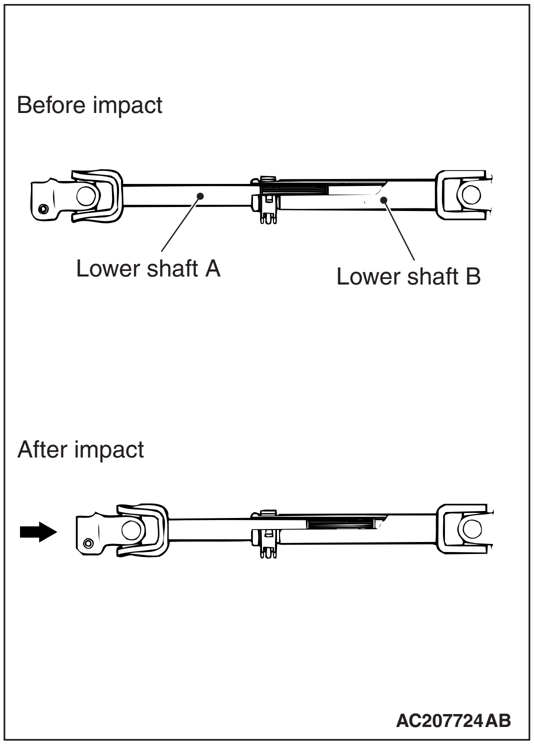
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Tilt steering mechanism allowing desired driving position (tilt-up/tilt-down: 15mm/20mm) has been installed for all models. Additionally, impact-absorbing mechanism has been introduced to the steering column to absorb an impact during collision and protect driver.

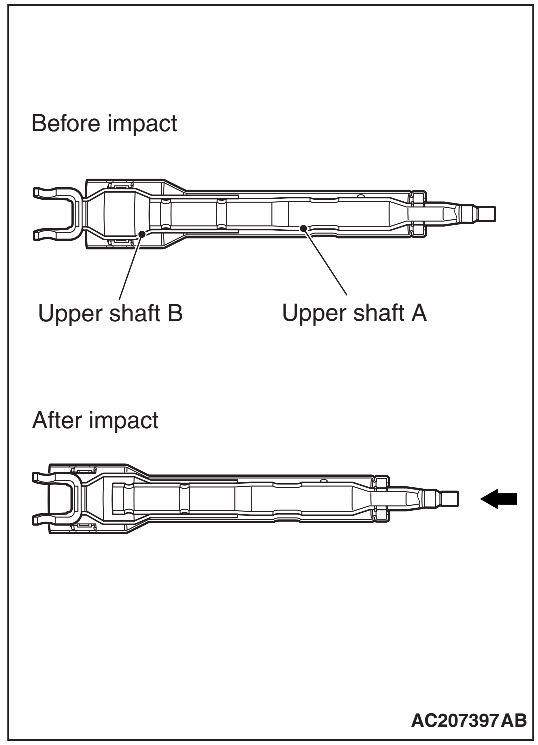
IMPACT-ABSORBING MECHANISM

Primary collision



When a vehicle is crashed and the lower shaft is loaded from the gearbox side, the lower shaft A is forced into the lower shaft B to absorb an impact load. Thus, the steering column will not be projected into the passenger compartment to reduce possible chest injuries.

SECONDARY COLLISION



When the driver's weight is loaded to the steering wheel after air bag deployment, the steering column separation mechanism built into the rotational axis of the upper-side tilt lever (tilt bolt) and the lower-side tilt fulcrum (tilt pin) moves the steering column assembly forward. The upper shaft can also be further retracted forward as shown in the figure.

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ELECTRICAL POWER STEERING

GENERAL INFORMATION

M2370000100862

Vehicle-speed sensitive electric power steering (whole range type) has been adopted. This system allows a light steering force during stationary steering manoeuvre or low speed driving, and a moderate steering force during medium or high speed driving. For vehicles with this system, the electric power steering-ECU controls the motor current according to the vehicle speed and steering force of the steering wheel.

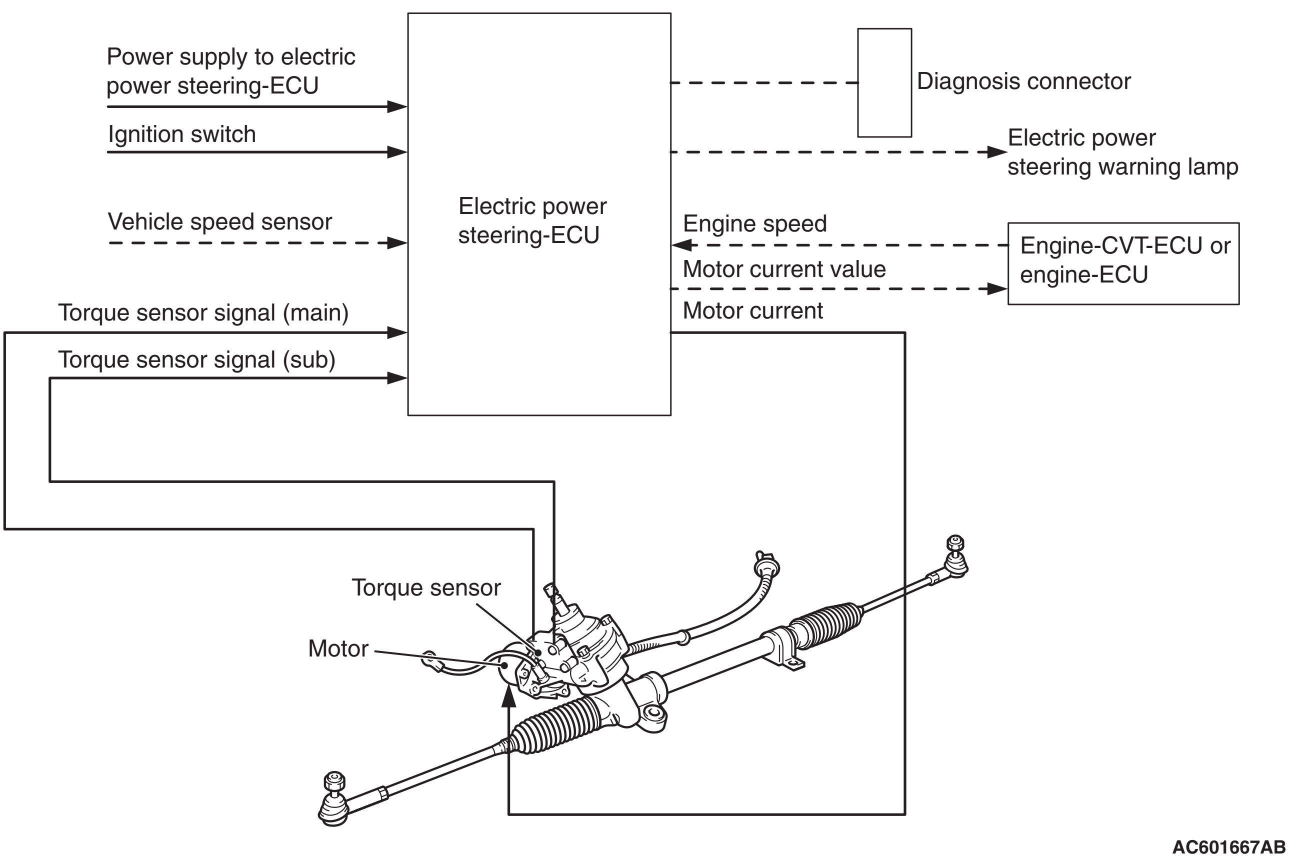
CAN* communication has been adopted in order to communicate with another ECUs for obtaining necessary information related to this control, achieving wiring harness saving and secure data communication.

*NOTE: *: For more information about CAN (Controller Area Network), refer to GROUP 54C, General Information P.54C-2.*

SPECIFICATIONS

Item		Specification
Motor	Type	Permanent magnetic field type
	Rated voltage (V)	DC12
	Rated current (A)	50
Torque sensor	Type	Noncontact type (Inductance detection type)
Electric power steering-ECU	Control type	Microcomputer control (16 bit)
	Rated voltage (V)	DC12

SYSTEM CONFIGURATION



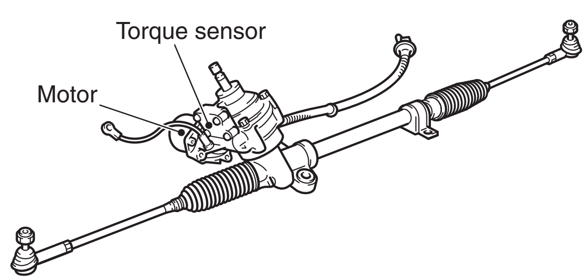
NOTE: Dashed lines indicate CAN-bus lines.

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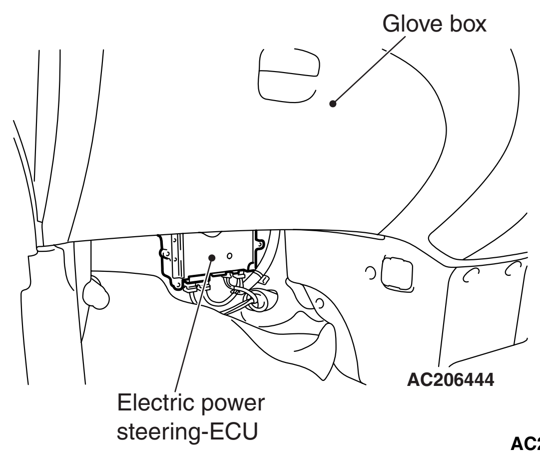
ELECTRICAL PARTS AND FUNCTIONS

Parts name		Description about function
Sensor	Vehicle speed sensor (ABS-ECU)	Sends the vehicle speed signal to the electric power steering-ECU.
	Torque sensor	Detects a steering force, converts it into the voltage signal, and then sends the signal to the electric power steering-ECU.
Actuator	Motor	Generates assist torque by the steering operation to the steering gear using the signals sent from the electric power steering-ECU.
	Electric power steering warning lamp	Warns a driver of the system malfunction using the signal sent from the electric power steering-ECU.
Electric power steering-ECU		Control the actuator (motor) based on the signal sent from sensor.
		Controls the self-diagnostic function and fail-safe function.
		Controls diagnostic function (Compatible with M.U.T.-III).

GENERAL DESCRIPTION ON SYSTEM



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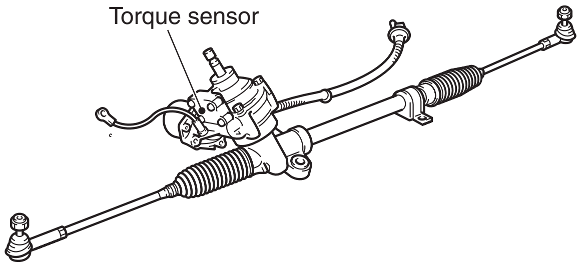


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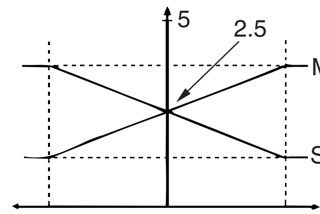
To improve operational reliability, the dual-circuit system has been adopted for the torque sensor. If any malfunction occurs in the electric power steering system, the fail-safe function of the electric power steering-ECU is activated, and the output current of the electric power steering-ECU applied to the motor is turned off. At the same time, the steering system enters manual mode, and informs a driver of the system malfunction by illuminating the warning lamp on the combination meter. The warning lamp illuminates when the following malfunctions occur: open circuit in the electric power steering system wiring harness, poor connection, malfunctions in the electric power steering-ECU, motor, or sensors.

STEERING GEAR

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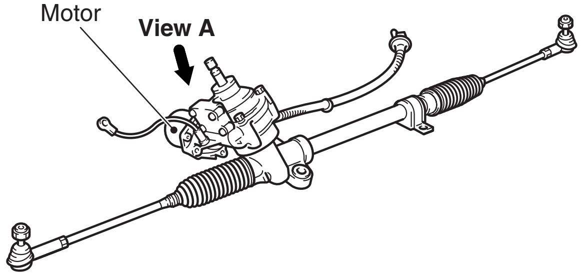
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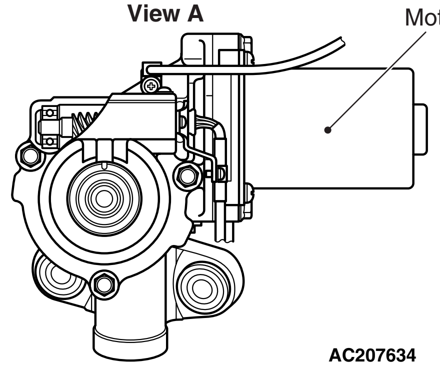
The torque sensor which detects a operated force of the steering wheel is installed in the steering gear. When the steering wheel is turned, the steering force is detected by the torque sensor. At the same time, 2-way supply voltage signal (main and sub) are input to the electric power steering-ECU.

MOTOR

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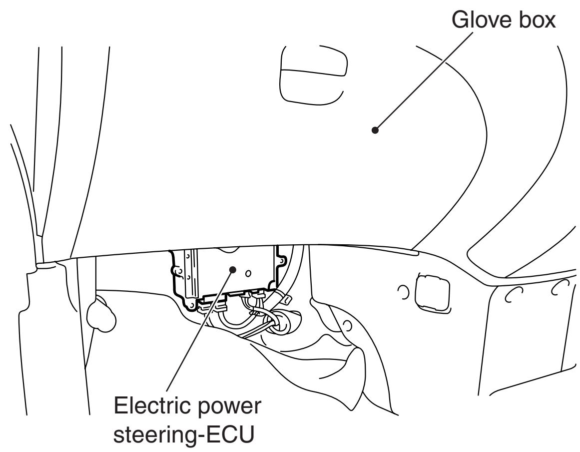
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The motor is installed in the steering gear. The steering motor is applied with a control current sent from the electric power steering-ECU and generates the assist torque to the steering gear according to the steering operation.

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ELECTRIC POWER STEERING-ECU

M2370000800106



The electric power steering-ECU is attached below the glove box, which is integrated with an input interface circuit, a microcomputer, an output drive circuit, a fail-safe relay, and a motor line relay etc.
It is also integrated with a self-diagnostic function, and illuminates the warning lamp and sets diagnosis code to the diagnosis connector.

CAN COMMUNICATION

The electric power steering-ECU performs the data transfer with another ECUs through CAN communication.

Signal	**Receiver ECU**	
	Engine-CVT-ECU or engine-ECU	**Meter and A/C-ECU**
Motor current signal	●	–
Electric power steering warning lamp request signal	–	●

NOTE: ● indicates items which sends and receives data through CAN communication.

FAIL - SAFE FUNCTION

If the electric power steering-ECU detects any malfunction, it illuminates the warning lamp, deactivates the electric power steering function, and then switches the steering system into manual mode.

DIAGNOSTIC FUNCTION

Electric power steering-ECU has the following functions for easier system checks.

- Diagnosis code set
- Service data output

All the above items can be diagnosed using M.U.T.-III.

DIAGNOSIS CODE SET

There are 22 diagnostic items. Since all the diagnostic results are recorded in volatile memory (EEPROM*), they are stored in the memory even though the battery terminals are disconnected.

NOTE:

- **: EEPROM (Electrical Erasable & Programmable ROM) Special type of memory that can be programmed or erased electrically.*
- *For each diagnostic item, refer to the Maintenance Manual.*

SERVICE DATA OUTPUT

Using M.U.T.-III, the input data sent from the sensors and motors can be read.

NOTE: For each service data item, refer to the Maintenance Manual.

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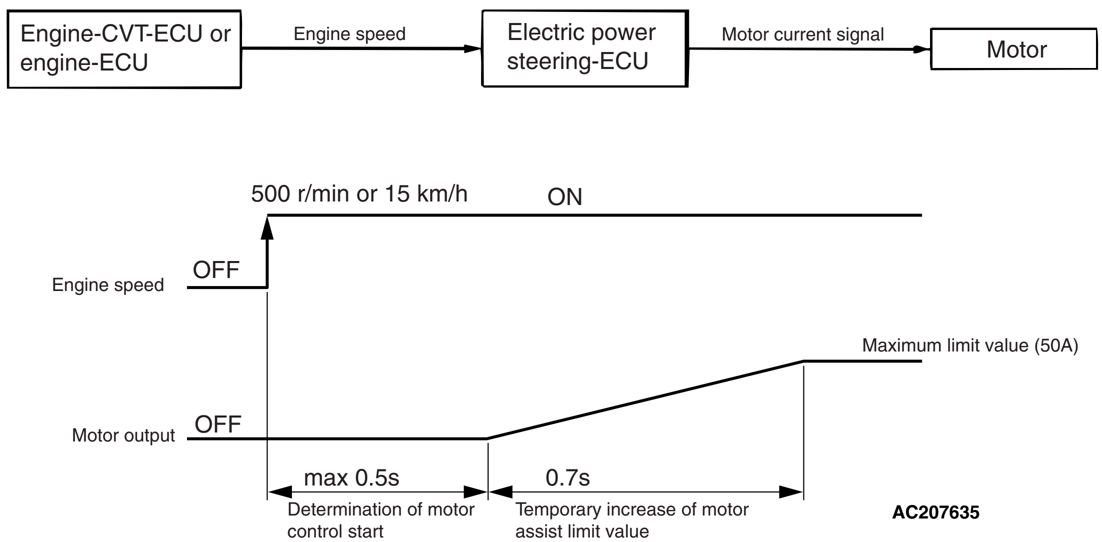
OPERATION

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IGNITION SWITCH ON

Ignition supply voltage is applied to the electric power steering-ECU, and the ECU enters standby mode.

IGNITION SWITCH ON

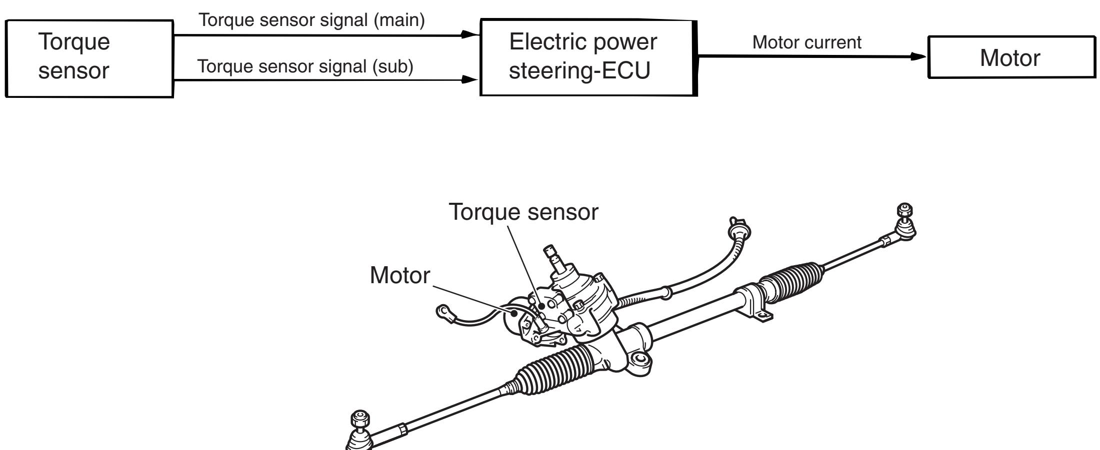


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1. When the engine is started, the engine speed signal sent from the engine-CVT-ECU or engine-ECU is input to the electric power steering-ECU.
2. After starting the engine, the electric power steering-ECU judges the engine status "ENGINE SPEED ON" when the engine speed reaches 500 r/min or the vehicle speed reaches 15 km/h or more, then the power assist function is ready.

STEERING WHEEL OPERATION



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FAIL-SAFE FUNCTION OPERATION

During the fail-safe mode, the electric power steering operates as a manual steering system.